AQUATIC HYMENOPTERA IN AMERICA.

Robert Matheson and C. R. Crosby.

This article is intended primarily to call attention to an almost entirely neglected field of entomological research, at least in this country, namely—the study of the habits and life-histories of those minute hymenopterous insects that have assumed aquatic life. In Europe considerable work has been done along this line. As early as 1836, F. Walker observed *Agriotypus armatus* (an anomalous Ichneumon fly) descend some distance into the water. Von Siebold (1858), W. Müller (1888), and others have shown that it is parasitic on Trichopterous larvæ. In 1863 Sir John Lubbock published his well known account of *Polynema natans* and *Prestwichia aquatica*, both with aquatic habits, the former swimming by means of its wings, the latter using its legs. Nothing was known by him regarding their earlier stages. Enock, Heymons and Willem have since reared *Prestwichia aquatica* from a variety of insect eggs, including Notonecta, Ranatra, Dytiscus and Pelobius.

In 1908, Heymons reared from eggs of a dragon-fly a Mymarid (*Anagrus subfuscus*) which although provided with wings kept them closed and swam with its legs. He also observed *Gyrocampa stagnalis*, a Braconid, swimming under water by means of its legs. Other European workers have made similar observations on the same or related species.

Our notes refer to three species, all reared at Ithaca, N. Y.

Hydrophylax aquivolans n. gen. and n. sp.

In September, 1908, Dr. J. G. Needham observed a number of minute Trichogrammids swimming by means of their wings in an aquarium which contained eggs of *Ischnura*, probably *verticalis*. These were again observed by him in the summer of 1911. Nothing is known regarding their earlier stages.

This species is apparently undescribed and runs to the genus *Asynacta* Foerster in Ashmead's tables (Chalcis Flies, p. 359, 1904). Foerster used the name *Asynacta* in a table in his Hymenopteren Studien, II, p. 87, 1856, but no species has ever been placed in the genus, and it is therefore a *nomen nudum*. In any case, although the present species agrees with Asynacta Foerster in antennal characters it would be separated from that genus by the extremely narrow wings which are abnormal to

that group. For it is only fair to assume that the wings in Asynacta are of the usual type, otherwise Foerster would have mentioned it in his description of the genus.

Hydrophylax. New genus. Antennæ 8-jointed; scape, pedicel, ring joint, 2 funicle joints and 3-jointed club. Fore wings extremely narrow, twenty times as long as wide; marginal cilia at least four times as long as the width of wing. Abdomen is conic-ovate, broadly joined to the body. Ovipositor slightly exserted.

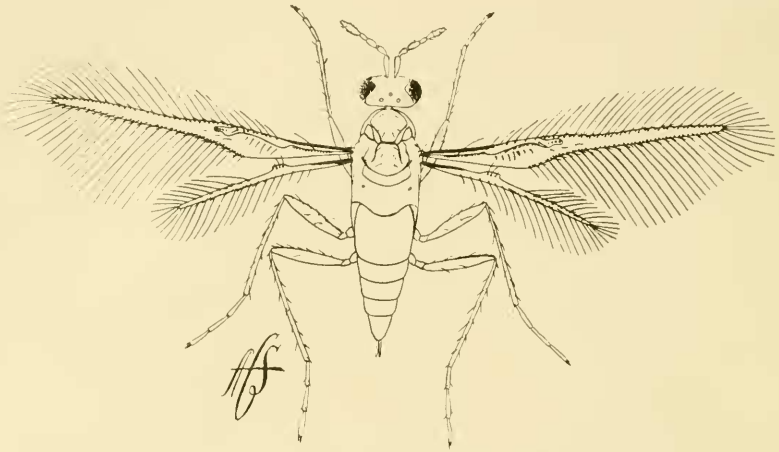

FIG. 1. *Hydrophylax aquivolans*.
Drawn by Miss Anna C. Stryke.

Type, the following species.

Hydrophylax aquivolans. New species. ♀ length .6 mm. Length of fore wing .69 mm.; hind wing .45 mm. (Fig. 1.)

General color light brownish yellow. Legs and antennæ paler. Head seen from above gently concave in front and behind, sparsely clothed with a few stiff setæ. Thorax smooth, clothed with stronger setæ. Scutellum gently rounded behind.

Postscutellum with two fine setæ, close together on each side. Propodeum smooth, without setæ except near the spiracles. Metathoracic spiracles enlarged, with two short, knobbed hairs which appear to arise within the opening.

Abdomen conic-ovate, sparsely clothed with long stiff setæ, broadly joined to the thorax; 5 visible dorsal segments; length of abdominal segments in the ratio of 5, 2, 2, 2, 3. Ovipositor exserted about the length of the shortest abdominal segment.

Antennæ 8-jointed, consisting of scape, pedicel, 1 ring joint, 2 funicle joints and a 3-jointed club. Scape compressed, elongate-oval; pedicel as long as the first joint of funicle and ring joint, elongate-obconic; first funicle joint cylindrical, 1½ times as long as the second; second slightly oval; club elongate-oval, 1-5 longer than the funicle. Anterior and middle femora slightly enlarged medially, the posterior femora more distinctly enlarged. Anterior and middle tibiæ of about same width throughout. Posterior tibiæ somewhat enlarged distally and slightly narrowed just before the tip. First and second posterior tarsal joints of equal length, the third somewhat shorter.

Front wings very narrow, 20 times as long as broad. Marginal cilia very long and evenly spaced, those on the posterior margin four times as long as the wing is wide. Marginal cilia are interspersed with a submarginal row of short setæ.

♂ Length .6 mm. Similar to the female. Antennæ 8-segmented, consisting of a scape, pedicel, a ring joint, 5 funicle joints, the last three more closely united. Scape compressed; pedicel obconic; ring joint distinct; first funicle joint about 1½ times longer than second, thicker at base than apex. The remaining joints sub-equal in length, the last two thicker than the preceding. Apical joint pointed at tip. Antennæ clothed with stiff setæ, which are longer than those of the female.

Limnodytes gerriphagus Marchal.

On June 16, 1911, we reared a species of Proctotrypidæ from the eggs of a water strider (*Gerris remigis*). Both males and females were observed swimming actively under water by means of their wings. They readily broke the surface film and made their escape flying in the air. They were observed to re-enter the water and examine carefully the surface of the leaf as if searching for the eggs of their host. The eggs of Gerris are laid in a single row in gelatine on the under side of the floating leaves of aquatic plants. The females were observed ovipositing in the eggs of Gerris. In the field several of these parasites were found on the under side of a floating leaf on the egg mass of Gerris. Only a single parasite emerged from each egg.

We have determined this species as *Limnodytes gerriphagus* Marchal, described in 1900 from specimens reared from the eggs of Gerris collected in the vicinity of Paris. Although our specimens agree with his descriptions and figures, yet to be

certain of our identification we have sent specimens to Dr. Marchal for comparison. In a letter of February 9, 1912, Dr. Marchal informs us that our specimens are identical with *Linnodytes gerriphagus*.

Caraphractus cinctus Walker.

On December 7, 1911, we collected some aquatic plants (*Ludvigia palustris*) from a small pond at Ithaca, in the stems of which we found an abundant supply of the eggs of one of the back swimmers (*Notonecta*). Over half of these eggs contained larvæ of a Hymenopterous parasite in which could be observed the legs and antennæ of the developing pupæ. Four to five larvæ were found in each egg. The heads of all did not point in the same direction. Plant stems containing a supply of these eggs were kept in aquaria in a warm room and on December 19, some young back-swimmers had hatched and were swimming actively about. Adults of the parasite had also emerged and were observed to be actively swimming in the water. One of the parasitized eggs was removed from the stem and placed under the microscope. It contained four adults, one of which, a male, was beginning to gnaw a hole in the end of the egg shell. This male emerged within five minutes, and taking a position on the top of the egg shell stripped off the pupal sheath from antennæ and legs. This one was followed by a second male and two females, all emerging within nine minutes through the same opening.

The adults of this species seem perfectly at home under water and swim quite rapidly by means of their wings with a jerky motion, corresponding to the wing strokes made at the rate of about two per second. The legs are trailed behind and are not used in swimming. They spend much of their time walking nervously over the stems of submerged plants, the surface of which they examine carefully with the tips of their antennæ, as if searching for eggs in which to oviposit. They are able to walk on the sides of the glass aquaria and on the under side of the surface film. After transferring a jar of water containing these parasites from one building to another a number were found on the upper side of the surface film in the air and flew across the surface trailing their legs attached to the film. They emerge from the water by crawling up some object and forcing their way through the surface film. (Fig. 2.)

In three cases we observed males and females apparently in copulation under water on the stems of the plants. We have not had opportunity to observe oviposition although females have been seen several times attempting to insert the ovipositor in the eggs of Notonecta which were nearly ready to hatch.

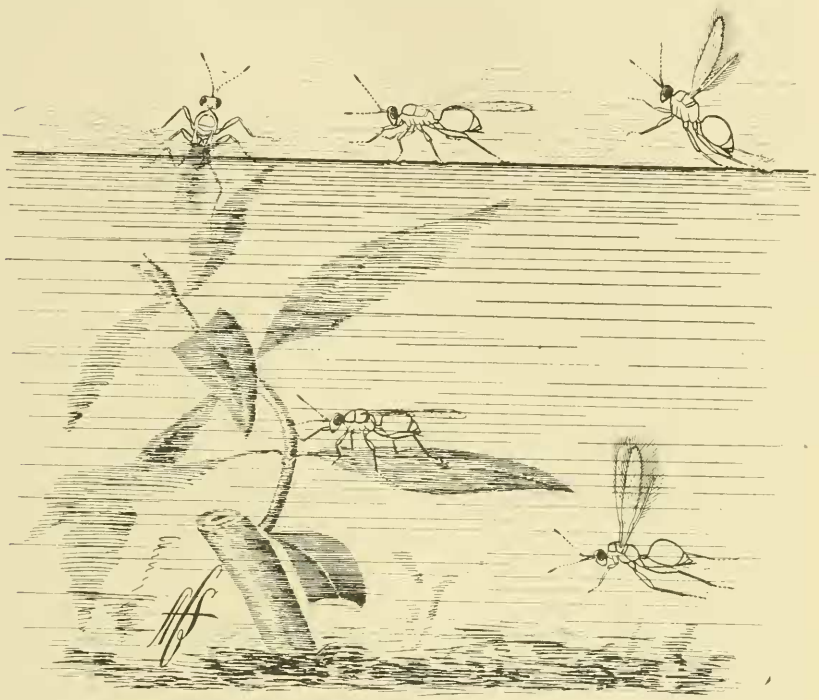

FIG. 2. *Caraphractus cinctus* Walker.
Drawn from life by Miss Anna C. Stryke.

We have been unable to see any external air supply carried by these insects while under water. While submerged they appear to be perfectly wet but as soon as they emerge into the air they seem to be perfectly dry. They are able to live submerged in water for over 12 hours in a bottle filled full of water and corked.

FIG. 3. Egg of *Caraphractus cinctus* Walker.

The egg of *Caraphractus cinctus* as dissected from the female is white, elongate-ovate, and provided with a short pedicel at its larger end (Fig. 3). Length .16 mm.; width .043 mm. The ovaries contain a large number of eggs.

Caraphractus cinctus Walker is an older name for *Polynema natans* Lubbock. Upon finding that our specimens agreed with the figures and description of the latter as given by Lubbock (1863) we forwarded specimens to him for identification. Lord Avebury kindly sent these specimens to Mr. Fred Enock for comparison with British examples. After examination Mr. Enock informs us that he is of the opinion that they are identical.

LIST OF KNOWN AQUATIC HYMENOPTERA.

CHALCIDIDÆ.

Prestwichia aquatica Lubbock, 1863. Parasitic on the eggs of *Notonecta*, *Ranatra*, *Dytiscus*, and *Pelobius*.

Hydrophylax aquivolans Matheson and Crosby, 1912. Parasitic on the eggs of *Ischnura*. (New York).

PROCTROTRYPIDÆ.

Limnodytes gerriphagus Marchal, 1900. Parasitic on the eggs of *Gerris* spp. (France and New York).

Limnodytes setosus De-Stefani Perez, 1902. Parasitic on the eggs of *Gerris* sp. (Sicily).

MYMARIDÆ.

Caraphractus cinctus Walker, 1846. (*Polynema natans* Lubbock, 1863). Parasitic on the eggs of *Notonecta*. (England and New York).

Anagrus subfuscus Heymons, 1908. Parasitic on the eggs of *Calopteryx virgo* L. (Germany).

BRACONIDÆ.

Gyrocampa stagnalis Heymons,1908. Host unknown.(Europe)

Dacnusa rousseaui Schulz, 1907. (Europe).

Chorebus natator Schulz, 1907. (Europe).

AGRIOTYPIDÆ.

Agriotypus armatus Walker, 1836. Parasitic on larvæ of Trichoptera.

BIBLIOGRAPHY.

Curtis, John—1832. British Entomology. No. 389.

De-Stefani Perez, T.—1902. Osservazioni biologiche sopra un Braconide acquatico, *Giardinaia urinator*, e descrizione di due altri Immenotteri nuovi. Zool. Jahrb. Syst. XV, pp. 625–633, Taf. 34.

Enock, Fred—1896. Notes on Aquatic Hymenoptera and rediscovery of *Prestwichia aquatica* (Lubbock). Jour. Quekett Mic. Club. VI (2), pp. 275–277.
1898. Aquatic Hymenopteron. Nature. LVIII, p. 175.
1898. Notes on the early stages of *Prestwichia aquatica* Lubbock. Ent. Mag. XXXIV, p. 152.
1899. (No title). Proc. Ent. Soc. Lond. p. XV.
1900. (No title). Proc. Ent. Soc. Lond. p. XII.

Heymons, Richard—1908. Susswasser-Hymenopteren aus der Umgebung Berlins. Deutsch. Ent. Zeit. pp. 137-150.

Klapalek, Fr.—1889. *Agriotypus armatus* (Walker) Curtis; its life-history and geographical distribution. Ent. Mo. Mag. XXV, pp. 339–343.

Kollar, V.—1857. Beitrag zur Kenntnis ueber die geographische Verbreitung des *Agriotypus armatus* Walker. Verhandl. Wien zool.-bot. Ver., pp. 189–190.

Lubbock, Sir John—1863. On two aquatic Hymenoptera, one of which uses its wings in swimming. Trans. Linn. Soc. Lond. (Zool.) XXIV, pp. 135–141. Plate 23, Figs. 10–15.

Marchal, Paul—1900. Sur un Nouvel Hymenoptère aquatique. Le *Limnodytes gerriphagus* n. gen., n. sp. Ann. Soc. Ent. Fr. LXIX, p. 171–176.

Muller, W.—1889. Ueber *Agriotypus armatus*. Zool. Jahrb. Abth. f. Syst. IV, pp. 1132–1134.

Rousseau, E.—1907. Les Hyménoptères aquatiques, avec description de deux espèces nouvelles par W. A. Schulz. Ann. Biol. Lacustre Bruxelles, II, pp. 388–401.

Schulz, W. A.—1907. Schwimmende Braconiden. Ann. Soc. Ent. Belg., LI, pp. 164–173.

Von Siebold, C. T. E.—1858. Ueber *Agriotypus armatus* in *Trichostoma picicorne*. Amtl. Bericht d. Versamml. d. Naturforscher in Carlsruhe., p. 211.
1861. Ueber *Agriotypus armatus*. Stett. Ent. Zeit., pp. 59–61.

Walker, Francis—1836. *Agriotypus armatus*. Entomol. Mag. p. 412.
1846. Descriptions of Mymaridæ. Ann. Mag. Nat. Hist., XVIII, p. 52.
1873. Notes on the Mymaridæ. The Entomologist, VI, pp. 498–502 (p. 501).

Willem, Victor—1896. Note sur le male de *Prestwichia aquatica* Lubbock. Ann. Soc. Ent. Belgique, XL, pp. 497–499.
1897. Description de *Prestwichia aquatica* Lubbock. Bull. Scient. France et Belg. XXX, pp. 265–271, pl. XIV.